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ABSTRACT

Following an introductory section outlining basic concepts of systems theory, this paper presents a model for the examination of the relationship between formalized teacher education and larger systems. These systems include the university system, the field of education as a system, and the societal system in general. The first part of the model is an input-structure-output matrix; the second is a similar matrix which focuses on goals and evaluation methods and criteria. The second matrix is designed to facilitate examination of the systems in question according to certain criteria for a type of intersystemic relationship call "synergy." Synergy is considered a desirable phenomenon since it results from similar subsystems functioning so closely that the total effect is greater than sum of the subsystem effects. Sample data is provided for each matrix based on a study of the literature. It is suggested that the model would be most useful in specific research performed within a given region or national subsystem. (RT)

Brief Title:

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THE INTERRELATION OF SYSTEMS: A SYSTEMS LOOK AT WHERE TEACHER EDUCATION FITS INTO THE WHOLE OF EDUCATION, UNIVERSITY, AND SOCIETY

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FOREWORD

The model explicated in this paper was initially presented at a clinical workshop of senior professors and deans from teacher training institutions during the February 1971 convention of the American Association of Colleges for Teacher Education in Chicago.

The Clearinghouse has worked with the AACTE Committee on Studies to develop this publication. This cooperation is an example of efforts to collaborate with Clearinghouse sponsors in identifying significant topics and writers. Recognition is due Dr. Mark Smith, AACTE associate director who had staff responsibility for the functioning of the Committee on Studies.

A major contribution to this work was a Query search of ERIC documents by Mrs. Moira B. Mathieson, Clearinghouse information analyst. Mrs. Margaret Donley, Clearinghouse publications coordinator; Mrs. Lorraine Poliakoff, senior information analyst; Miss Christine Pazak, publications assistant, have converted the author's manuscript into this published form.

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--Joel L. Burdin
Director

January 1972

THE INTERRELATION OF SYSTEMS: A SYSTEMS LOOK AT WHERE TEACHER EDUCATION FITS INTO THE WHOLE OF EDUCATION, UNIVERSITY, AND SOCIETY

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INTRODUCTION

This paper presents a model, based upon concepts derived from general system theory, for the examination of the relationship between formalized teacher education and larger systems. These systems include the university system, the field of education as a system, and the societal system in general.

The model is in two parts. The first is an input-structure-output matrix used to delimit data and loci. The second is a similar matrix which facilitates examination of the systems in question according to certain criteria for the (desired) second order of intersystemic relationships--the "synergy." In addition, an attempt is made to classify these relationships and to identify the implications for teacher education systems. A preliminary section contains certain basic concepts of general system theory.

The magnitude of this task should be evident, as should the inherent difficulties, since each of the systems identified may be seen as a macrosystem in itself. They are huge, complex systems which when placed on a continuum show similarities and differences within themselves. These apparent disparities are generally a function of social influence, demography, or traits peculiar to a given national sector. Moreover, the very existence of macrosystems of the sort being examined somewhat contiguously introduces the problem of spatial blur in which inputs, client-members, and overall spatiality are unclear in terms of boundaries. Thus, as will be seen in the model, a given input, such as "value system," tends to exist within each macrosystem as one becomes a suprasystem for a smaller system. Hopefully, the degree of specificity increases as a function of the scrutiny from suprasystems to subsystems. On the other hand, a systems-oriented model does permit an individual to apply the framework within the parameters of a delimited geographic or economic region--a feature whose utility is recognized by the more minute focus it offers a given region.

THE CONCEPT OF SYSTEM

A system may be defined as "a set of interacting units with spatial as well as temporal boundaries."[1] In addition, systems exist with a definable orientation, that is, with a purpose. In the context of this

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[1]Francis J. Pilecki, "The Systems Perspective and Leadership in the Educational Organization," Journal of Education, 153:50; October 1970.

paper, it may readily be seen that with the exception of the smallest system, all systems contain smaller (sub-) systems. With the exception of the largest system, all systems are part of larger (supra-) systems. The following illustration will clarify.

One of the systems being considered in this paper is the field of education. In America there are included some 120,000 elementary and secondary schools and nearly 2,500 universities and colleges. There are also included about 55 million students, instructors, and administrators. The potential number of useful subsystems is a function of mathematical combinations. Not to be overlooked as subsystems would be an individual student or an individual instructor. On the other hand, the field of education exists within the suprasystem of the American societal system, and so forth.

The education system may be seen as a macrosystem because of the complexity of major subsystems within it. Marien includes the following:

1. Educating Institutions: higher educating systems of graduate, undergraduate, and junior college institutions;
2. Periphery: education as a part of corporations, the military, proprietary endeavors, correspondence schools, vocational training, anti-poverty programs, educational television, other adult education, and other child education systems;
3. Foreign Extensions: of (1) educating institutions, and (2) periphery;
4. Organized Beneficiaries: Institutions, academic and other professionals, and student, parent, and alumni clientele; and,
5. Selected Suppliers: Accrediting associations, testing organizations, educational research groups, and the educationally related components,of governments, industry, publishers, foundations, and consultant organizations.[2]

Systems share certain commonalities. As "open" systems they exchange energies with their environments. This is done through the conversion of incoming energies (inputs) to products and/or effects (outputs) through a series of processes and controls (system structure). The key to system productivity in terms of outputs is the interrelationships within the system structure. Thus, the bases for the model to be presented below are in the input-output linkages and the subsystemic interrelationships.

Other commonalities exist. There is a tendency in all systems towards entropy or the states of disorder, randomness, chaos, and death. The tendency away from entropy (negentropy) may be induced through an adaptation in system action such as new goals, new strategies, or new outputs--all functions of relevant responsiveness to environmental thrusts. Similarly,

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[2]Michael Marien, "Notes on the Education Complex as an Emerging Macrosystem," Man in Systems, ed. Milton D. Rubin (New York: Gordon and Breach Science Publishers, 1971), p. 186 *ff*.

within systems there is at once a tendency for the system to break apart (progressive segregation) and to become more unified (progressive mechanization). An example of these phenomena is the frequent tendency towards individuality within the ranks of the states while working towards a stronger federal unity as a nation. Also, systems may achieve similar outputs despite disparate starting conditions (equifinality).[3]

There are essentially three types of intra- and inter-relationships between systems and subsystems.

> First, there is the functioning of dissimilar subsystems toward a common goal. Such subsystems depend upon each other for their individual existence and survival. Next is the functioning of similar subsystems in such close relationship that the result is greater than any subsystem functioning independently. This is termed a 'synergistic' relationship. The third order relationship is identifiable when similar subsystems either duplicate or work in opposition to the others' actions. Hence, redundant or contradictory relationships.[4]

The development of synergistic relationships is paramount to harmonious achievement of systemic goals since they maximize the effectiveness of the systems involved and minimize the potential for abuse of smaller systems, including individuals.[5] The term "synergy" is derived from "synchronized energy," and its initial use in the social sciences is attributed to Benedict.[6] The concept has special signficance in terms of the scrutiny of ultimate functioning among the systems, indeed macrosystems, to which this paper is addressed.

THE MODEL

The first segment of the model attempts to present the basic input→structure→output schema in relation to the system of teacher education. To accomplish this, it is necessary to identify the inputs and other properties from each of the following systems: teacher training colleges, universities, the field of education, and society. Thus, a matrix is used so that major energies from each system can be identified if only that they may be seen coming more from one system than the others. As stated

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[3]A reader interested in pursuing the study of system properties and components may be interested in Glenn L. Immegart and Francis J. Pilecki's Systems Theory for Educational Administrators (Reading, Mass.: Addison-Wesley, 1972).

[4]Pilecki, op. cit., pp. 51-52.

[5]Francis J. Pilecki, "Coordinating Human Resources," Planned Change in Education: A Systems Approach, ed. David S. Bushnell and Donald Rappaport (New York: Harcourt, Brace, Jovanovich, 1971), pp. 19-20.

[6]Abraham H. Maslow, "Synergy in the Society and in the Individual," Journal of Individual Psychology, 20:153; November 1964.

previously, the fact that each system may well be a macrosystem existing in yet larger systems would seem to preclude simple system-negasystem contrasts.

The basis for this model is derived from the research Immegart did in his attempt to formulate a taxonomy of organizational behavior in education.[7] (Needless to say, the more generic "black box" depiction of system stems from the writings of Ashby.)

Inputs are seen to be of two types: operand inputs are those energies acted upon; operator inputs are those which act to effect further system action. The structure of the system is similarly subdivided into processes--decision making, communications, and other actions which convert inputs to outputs--and controls--system monitors on processing. Finally, outputs are divided into productivity, affectivity, and feedback. Productivity is the tangible results or substantive outcomes of system action, affectivity is the sensed impact or intangible outcomes of system action, and feedback is evaluative information resulting from system action.

The following matrix illustrates the foregoing.

MATRIX 1.0

	SYSTEM: Teacher Education						
	INPUTS		STRUCTURE		OUTPUTS		
	Operand	Operator	Processes	Controls	Productivity	Affectivity	Feedback
SOCIETY							
EDUCATION							
UNIVERSITIES							
TEACHER TRAINING COLLEGES							

[7] Glenn L. Immegart, "Systems Theory and Taxonomic Inquiry into Organizational Behavior in Education," Development Taxonomies of Organizational Behavior in Education Administration, ed. Daniel E. Griffiths (Chicago: Rand McNally, 1969), pp. 165-238.

In Matrix 1.1 an attempt has been made to provide certain data appropriate to the related system and the specific property of the teacher education system. These data are general in nature and would seem to be valid for various national locations.

It would now seem appropriate to examine the suggested relationships in terms of the systemic relationship order. Since the symbiotic relationship is a mutual linkage vital to the continuation of involved unlike systems, it would seem that such a linkage need not be dealt with in great detail. Rather, careful scrutiny should be given the criteria for synergistic relationships as well as the converse, that is, the contradictory or redundant relationships. There are several criteria for establishing synergy:

> First, the final or overall objective of the system must be understood and accepted by (all) . . . and consequently, must direct that system. Redundant and contradictory relationships occur when the anticipated and desired output is vague, misunderstood, and not totally accepted.
>
> . . . Within any social system, apart from the final goal or desired output, there are subgoals and more immediately attainable objectives. These are the steps to be accomplished during the overall pursuit of reaching the final goal. To achieve synergy, these subgoals must be coordinated and contiguous tangential goals which do not fit into the total design tend to lead to contradictory effects.
>
> . . . At all levels goal achievement is a function of coordinated strategies known and agreed to by all affected subsystems. When each subsystem chooses an independent posture, there results a failure in the total system plan.
>
> Lastly, the criteria for assessing the achievement of goals must be measurable within defined ranges. . . . Redundancy of subsystem action is inevitable when the reliance is placed on achievement of the sub-goal only, if indeed any criterion is used at all.[8]

The four criteria cited above are shown in Matrix 2.0. The question being asked regards the anticipated output, the forces, the means, the assessment criteria of the teacher education system from the perspectives of society, the field of education, universities, and teacher training systems.

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[8]Pilecki, "The Systems Perspective," pp. 52-53.

MATRIX 1.1

SYSTEM: Teacher Education							
	INPUTS		STRUCTURE		OUTPUTS		
	Operand	Operator	Processes	Controls	Productivity	Affectivity	Feedback
SOCIETY	Need to transmit culture Need to control by various subsocietal systems	Individuals State Community USOE Political institutions Technology	Institutionalization into education in general and into universities and teacher training schools	Legislation Financial support Sense of morality	Educated citizenry	Willingness to perpetuate societial values	Evidence of citizenship Condition of society Goodness in behavior
FIELD OF EDUCATION	Proliferation of itself	Learned societies Professional groups Labor unions	Organization of academic disciplines	Lobbied laws, e.g., professional practice acts Accrediting groups	Cognitive advances	Attitudes towards knowledge and learning	Compliant behaviors
UNIVERSITIES	Teacher should be cultured Need for scholarship in use of produced knowledge	Continuum of specialization	Schools of education Departmental organization Curriculum	Exams Standards Admission requirements	Degree	Scholarly graduates	Alumni support Acceptance by graduate schools
TEACHER TRAINING COLLEGES	Specific goals and objectives Philosophies of education	Faculty Students	Education courses Practicum Models Student teaching	Supervision Exams Research papers Grades	Certification of new teachers	Professionalism	Accreditation Communities wanting and hiring graduates Retention

MATRIX 2.0

	SYSTEM: Teacher Education			
	END OBJECTIVES OR ANTICIPATED OUTPUT	SUBGOALS AND FORCES	MEANS FOR GOAL ACHIEVEMENT	CRITERIA FOR ASSESSING GOAL ACHIEVEMENT
SOCIETY				
FIELD OF EDUCATION				
UNIVERSITIES				
TEACHER TRAINING COLLEGES				

MATRIX 2.1

SYSTEM: Teacher Education				
	END OBJECTIVES OR ANTICIPATED OUTPUT	SUBGOALS AND FORCES	MEANS FOR GOAL ACHIEVEMENT	CRITERIA FOR ASSESSING GOAL ACHIEVEMENT
SOCIETY	Educated populace Employable teachers	Socialization of children Congruent values and attitudes	Provision of resources through institutions, materials, and legislation	Quality of community life More literate population Increased number of high school graduates
FIELD OF EDUCATION	Quality teachers Advance in knowledge	Training for vocations, occupations, professions--the world of work	Maintenance of teacher training colleges and programs	National assessment studies Accreditation ratings
UNIVERSITIES	Learned and inquiring men and women Competent teachers	Integration into the entire university complex of scholarship and knowledge	Exposure to successful practices Quality faculty Campus life Political forces	Satisfaction of teachers, students, and society Success of graduates Recognition Funding
TEACHER TRAINING COLLEGES	Dynamic young graduates Reconstruction of society Research Acceptance of graduates	Curriculum and study programs Freedom and inquiry Subject matter Certification	Research Curriculum Campus life Feedback Reward and punishment Example Peer Influence	Research outcomes New applicants for admission Effects on client school districts

IMPLICATIONS

In the foregoing section data were provided to complete each of the two matrices. These data were generated from a cursory review of the literature along with a consideration of the responses by clinical workshop participants referred to earlier. It is presupposed, however, that the real utility of this model would be found in its employment within a delimited geographic or regional boundary. Thus, one might seek to identify inputs from the various macrosystems as they exist in New England, the Northwest, or the Southeast. An array of responses from a cross-section of members from specific systems might well provide more precise and useful data.

These responses would then be scrutinized for similarities and dissimilarities both within each system and among systems. Data regarding the latter would be the basis for further scrutiny in terms of synergy-redundancy conflict. Data regarding the former may be useful in examining systemic progressive segregation and mechanization and might also allow at least conjectures, if not quantifiable information, regarding entropic-negentropic balances.

Merrimack-Andover Assessment

Using one facet of the foregoing model, the Merrimack Education Center[9] of Chelmsford, Massachusetts, in conjunction with the Andover, Massachusetts, Public Schools developed an instrument (*see* Matrix 3.0). The objective was to assess inputs from parents, students, educators, and the community regarding educational goals. A list of goals was presented, and members of each group (or system) were asked to rate each particular goal in terms of their perspective (actual responses). In addition, they were requested to rank each goal according to what they thought were the perspectives or priorities of other groups (perceived responses). A comparison of actual and perceived priorities was made, and it proved a useful method for identifying and, subsequently, for resolving inter-group conflicts--or, attempting to develop synergy.

In terms of the matrices presented in this paper, similar ranking procedures could be utilized, and chi-square formulae used to identify similarities and differences.

SUMMARY

Two matrices have been presented as a model for examining inter- and intra-systemic relationships between the system of teacher education and the systems of society, the field of education, universities, and teacher training colleges. The matrices were completed with generalized data derived from a literature search and a limited uni-occupational, though multi-geographical, population.

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[9]The Merrimack Education Center is an educational broker, funded from state, federal, and local monies.

MATRIX 3.0

MERRIMACK EDUCATION CENTER/ANDOVER GOAL EXERCISE[10]

GOALS (Rank each from 1: Low to 4: High) Quality education should:	(Circle the category to which you belong.) PARENTS	STUDENTS	TEACHERS and ADMIN.	COMMUNITY
I. Help every child acquire mastery of basic skills in the use of words and numbers.	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
II. Help every child acquire understanding of himself and an appreciation of his worthiness as a member of society.	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
III. Help every child acquire understanding and appreciation of those persons who are different from himself.	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
IV. Help every child acquire habits and attitudes of citizenship for participation in a democracy.	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
V. Help every child acquire skills necessary for family living.	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
VI. Help every child acquire skills in the areas of health and recreation for physical fitness and leisure time.	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
VII. Give every child opportunity to be creative and pursue independent projects in one or more fields of endeavor.	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
VIII. Help every child understand the opportunities open to him for vocational preparation and career goals.	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
IX. Help every child to prepare for a world of rapid change and unforeseeable demands in which continuing education throughout his adult life should be a normal expectation.	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
X. Help each child to associate learning in school with learning experiences outside the school.	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4

[10]The source of this instrument is The Merrimack Education Center, 101 Mill Road, Chelmsford, Massachusetts, Dr. Richard J. Lavin, Executive Director; and The Andover Public Schools, Andover, Massachusetts, Dr. Kenneth Seiffert, Superintendent.

This paper showed the utility of the model for more specific research which could be performed within a given region or national subsystem. A brief statement regarding concepts basic to general system theory was offered as an explanation and a rationale for both terms and methodology. This model may be useful for future research of a more intense nature.

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